

Science

Standard: The adult learner applies methods of science and technology toward the advancement of personal and community well being.

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Standard: The adult learner applies methods of science and technology toward the advancement of personal and community well being.

Pre-Literacy

Indicator A: Understands and uses the processes of scientific investigation and scientific ways of knowing. Able to design, conduct, describe and evaluate these investigations. Understands and applies concepts that unify scientific disciplines (Science as Inquiry)

1. Identifies and uses safe procedures in all science activities
2. Formulates basic questions about objects, organizations, events and relationships in a natural and designed world
3. Organizes (e.g., sort, classify, sequence) objects, organisms, and events by different characteristics
4. States simple hypothesis about cause-and-effect relationships in the environment
5. Performs simple measures and comparisons
6. Observes and describes simple systems (e.g., ant farm, plant terrarium, aquarium)
7. States examples of scientific inquiry familiar from previous life experience

Indicator B: Understands the impact of science and technology on human activity and the environment as it relates to the past, present and future (Science and Technology – Past, Present and Future)

1. Recognizes that all people can and do participate in science and technology
2. Identifies careers that apply science and technology
3. Identifies ways that scientific technology affects our daily lives, jobs and recreation
4. Demonstrates the proper use of simple technology (e.g., scales, balances, magnifiers, computers)

Indicator C: Understands the characteristics of living things and the diversity of life. Understands the interrelationships of matter and energy in living organisms and the interactions of living organisms with their environments (Life Science)

1. Describes the differences between living and non-living things
2. Describes the basic needs of living organisms for survival
3. Recognizes and distinguishes similarities and differences among diverse species
4. Identifies the various systems of the human body

Indicator D: Understands the nature of matter and energy including their forms, the changes they undergo and their interactions (Physical Science)

1. Identifies the physical properties of objects
2. Describes the physical properties (length, mass, volume, temperature, texture, etc.) common to various tangible objects
3. Compares objects in terms of physical properties

Indicator E: Understands the composition, formative processes, and history of the Earth, the solar system and the universe (Earth and Space Science)

1. Identifies the basic phenomena and dynamics of common objects in the sky (e.g. sunrise, moon, stars)
2. Identifies the position of the sun in relation to the nine planets
3. Identifies basic weather phenomena and their effect on daily activities
4. Identifies basic earth materials (rocks, soils, water, and gases) and their common uses
5. Identifies the major features of the earth's surface (mountains, rivers, plains, etc.)

ABE I

Indicator A: Understands and uses the processes of scientific investigation and scientific ways of knowing. Able to design, conduct, describe and evaluate these investigations. Understands and applies concepts that unify scientific disciplines (Science as Inquiry)

1. Plans, designs, conducts, and reports on the conclusions of a basic experiment
 - a. Plans and designs an experiment
 - b. Predicts the results of an experiment
 - c. Conducts an experiment and record data
 - d. Reports through various means, the conclusions of an experiment
2. Recognizes that when an experiment is repeated under the same conditions, the results are the same
3. Collects, sorts, catalogs, classifies, observes, measures, sketches, interviews, and surveys scientific data
4. Constructs models (e.g., a volcano, a paper airplane, a solar system) that illustrate simple concepts and compare those models to what they represent
5. Identifies and records changes and patterns of change in a familiar system (e.g., solar system, aquarium, or any simple machine, such as a clock or bicycle)
6. Identifies parts of a familiar system, and describes relationships among those parts (e.g., a bicycle, a park, a clock)
7. Identifies observable patterns in adult learners' lives, and predicts future events based on those patterns
8. Explains how the form or shape of an object or system is frequently related to its use, operation, or function
9. Distinguishes between natural objects and objects made by humans

Indicator B: Understands the impact of science and technology on human activity and the environment as it relates to the past, present and future (Science and Technology – Past, Present and Future)

1. Recognizes that scientific contributions have been made by all kinds of people everywhere in the world
2. Describes the results of scientific inquiry in the world (e.g., a timeline of inventions, progression from simple to mechanized tools, understanding weather patterns)
3. Recognizes that scientific inquiry has produced much knowledge about the world, that much is still unknown, and that some things will always be unknown
4. Explains how asking and answering questions are part of the process of scientific investigation and compare prior knowledge to the results of a scientific investigation
5. Identifies occupations that require the application of science and technology
6. Identifies which resources are limited and which resources can be extended through recycling and decreased use
7. Describes how the application of science may be used to change the quality of life, for better or worse, for people

8. Explains how physical environments change due to human activity (e.g., irrigation, dams and levees, offshore drilling)
9. Describes populations, resources, and environments (e.g., habitat, ecosystem, food chain), and explain interactions and interdependence among specific populations, resources, and environments
10. Identifies and describes how technology (e.g., zipper, paper clips, computers) contributes to solving problems

Indicator C: Understands the characteristics of living things, the diversity of life and how organisms change over time in terms of biological adaptations and genetics. Understands the interrelationships of matter and energy in living organisms and the interactions of living organisms with their environments (Life Science)

1. Describes and explains cause-and-effect relationships in living systems
2. Traces the life cycles of various organisms
3. Identifies the basic structures and describes the functions [of the basic structures] of plants and animals
4. Recognizes that component parts make up the human body systems (e.g., digestive, muscular, skeletal), including major organs (e.g., lungs, heart, skin) within systems
5. Recognizes that offspring within families have both similarities and differences
6. Identifies living versus non-living components within ecosystems and describes the interaction among the two
7. Describes relationships among various organisms in their environment (e.g., predator/prey, parasite/host, food chains and webs)
8. Classifies organisms according to common characteristics (e.g., bones, appendages)
9. Identifies some characteristics that are common to all individuals of a species/group and recognizes why there are differences and what they are
10. Explains that all organisms cause changes, some beneficial and detrimental, in the environments where they live

Indicator D: Understands the nature of matter and energy including their forms, the changes they undergo and their interactions (Physical Science)

1. Examines, describes, classifies, measures and compares tangible objects in terms of common physical properties (e.g., length, mass, volume, temperature, size, weight, shape, texture, flexibility, color)
2. Creates mixtures (e.g., salt and sand, iron filings and soil) and separates them based on differences in properties
3. Recognizes that objects can be made of one or more materials
4. Demonstrates that light, heat, motion, magnetism and sound can cause changes
5. Identifies the different states of matter and recognizes that matter can change and exist in one or more states
6. Recognizes that light travels in a straight line and can be reflected, refracted or absorbed

Indicator E: Understands the composition, formative processes, and history of the Earth, the solar system and the universe (Earth and Space Science)

1. Describes the basic Earth materials (rocks, soils, water and gases) and their physical properties
2. Identifies the planets and describes their relationship to the Sun
3. Recognizes that a major source of the Earth's heat and light is the Sun and describes the motion of the Earth in relation to the Sun, including the concepts of day, night, year, and the seasons
4. Identifies the seasons and their characteristics
5. Identifies and describes the patterns of movement of objects visible in the sky over time (e.g., seasonal position of the sun, constellations, the moon)
6. Identifies major features of Earth's surface (e.g., mountains, rivers, plains, plateaus) and the natural processes and forces that shape the Earth's surface, including weathering, erosion, earthquakes, floods, and volcanic activity that gradually and rapidly shape the Earth's surface
7. Describes natural events (e.g., volcanoes, hurricanes, tornadoes, earthquakes), and explains how they affect humans
8. Investigates and describes the general characteristics of atmosphere and the fundamental processes of weather
9. Collects and records weather data and note how human activities are affected by it
10. Describes the water resource, its uses, importance, and cyclic patterns of movement through the environment
11. Describes how fossils provide evidence about the plants and animals that lived long ago and the nature of the environment at the time

ABE II

Indicator A: Understands and uses the processes of scientific investigation and scientific ways of knowing. Able to design, conduct, describe and evaluate these investigations. Able to understand and apply concepts that unify scientific disciplines (Science as Inquiry)

1. Identifies a question, formulates a hypothesis, controls and manipulates variables, devises experiments, predicts outcomes, compares and analyzes results, and defends conclusions
 - a. Distinguishes between a question and a hypothesis
 - b. Describes the functions of variables in an investigation
 - c. Predicts an outcome based on experimental data
 - d. Draws a conclusion based on a set of experimental data
2. Designs a model to illustrate a system (e.g., a mobile of the solar system)
3. Organizes and presents data gathered from their own experiences, using appropriate mathematical analyses and graphical representations (e.g., bar graph, line graph, frequency table, Venn diagram)
4. Identifies and refines questions from previous investigations
5. Recognizes that conclusions are tentative and open to modification as new data are collected
6. Analyzes the processes, parts and subsystems of a bicycle, a clock or other mechanical or electrical device
 - a. Identifies the parts of a subsystem within a system
 - b. Describes the functions of a subsystem
 - c. States cause-and-effect relationships among components in mechanical or electrical devices
7. Analyzes the reliability of scientific reports from magazines, television or other media, using evidence to support or refute a conclusion drawn from a scientific report

Indicator B: Understands the impact of science and technology on human activity and the environment as it relates to the past, present and future (Science and Technology – Past, Present and Future)

1. Describes major scientific contributions
2. Describes how science and technology are interrelated
3. Provides different explanations for a phenomenon; defend and refute the explanations with evidence
4. Recognizes how scientific knowledge, thinking processes and skills are used in a great variety of careers
5. Develops and uses a systematic approach to describe the risks associated with natural and biological hazards
6. Uses scientific findings to propose and evaluate solutions to a human or environmental problem (e.g., water pollution, malnutrition, fire hazards), and modify the solutions to the problem, if necessary

7. Evaluates the possible strengths and weaknesses of a given solution to a problem
8. Explains how technological solutions have intended benefits and unintended consequences
9. Analyzes how the introduction of a new technology has affected human activity (e.g., invention of the telescope, applications of modern telecommunications)

Indicator C: Understands the characteristics of living things, the diversity of life and how organisms change over time in terms of biological adaptations and genetics. Understands the interrelationships of matter and energy in living organisms and the interactions of living organisms with their environments (Life Science)

1. Constructs a simple classification system based on physical characteristics of organisms
2. Identifies and differentiates between the basic structures and functions of various cells
3. Identifies the main structures of cells, tissues, and organ systems within an organism, and identifies the interrelationships among them
4. Identifies the major components of vital body systems and identifies the functions of those systems (e.g., digestion, respiration, reproduction, circulation, excretion, movement, control, coordination)
5. Describes organism adaptations or constancy over geologic time
6. Describes the role of genes in heredity, and distinguishes between physical characteristics which are, and are not, inherited
7. Describes the components of an ecosystem and how living components interact with non-living components. Explains that both components are interdependent within an ecosystem, including the adaptation of plants and animals to their environment

Indicator D: Understands the nature of matter and energy including their forms, the changes they undergo and their interactions (Physical Science)

1. Examines, describes, compares, measures, and classifies objects and mixtures of substances based on common physical and chemical properties (e.g., states of matter, mass, volume, electrical charge, density, boiling points, pH, magnetism, solubility)
2. Distinguishes between mixtures and compounds
3. Identifies various types of energy sources and describes how energy is transferred
4. Identifies and predicts what will change and what will remain unchanged when matter experiences an external force or energy change (e.g., boiling a liquid; comparing the force, distance and work involved in simple machines)
5. Describes, measures and calculates characteristics (e.g., speed, distance, mass, force, gravity) of moving objects and their interactions (e.g., force, velocity, acceleration, potential energy and kinetic energy) within a system

Indicator E: Understands the composition, formative processes, and history of the Earth, the solar system and the universe (Earth and Space Science)

1. Distinguishes between *revolution* and *rotation*
2. Describes common objects in the solar system and explains how they are related
3. Describes the layers of the Earth and their compositions
4. Explains how rocks, minerals and soil are formed
5. Describes how life and environmental conditions have changed over time (geologic and recent)
6. Identifies Earth processes and compares the processes that affect the Earth today with those that occurred in the past
7. Explains how water is cycled in nature and identifies the distribution of water on Earth, underground and in the atmosphere
8. Describes currents, waves, tides and ocean floor features
9. Describes the basic characteristics of the Earth's bodies of fresh water and salt water
10. Describes the difference between weather and climate
11. Defines basic terms associated with weather systems including fronts, pressure systems and types of clouds
12. Describes the properties and composition of the layers of the atmosphere
13. Explains how technology has impacted both Earth and space science

ABE III

Indicator A: Understands and uses the processes of scientific investigation and scientific ways of knowing. Able to design, conduct, describe and evaluate these investigations. Able to understand and apply concepts that unify scientific disciplines (Science as Inquiry)

1. Formulates questions directed toward objects and phenomena that can be described
2. Designs and executes scientific investigations, testing only one variable at a time using a control
3. Presents information in a formal laboratory report including gathering, recording, organizing data accurately and making correct use of histograms, stem and leaf plots, scatter plots, circle graphs, flow charts, line graphs, bar graphs, charts, etc
4. Interprets data; establishes relationships based on evidence and logical argument; draws conclusions/explanations
5. Proposes, analyzes, and critiques alternative explanations of phenomena
6. Defines the terms: hypothesis, model, principle, law, theory, and paradigm
7. Explains how scientific theory, hypothesis generation, and experimentation are related
8. Recognizes that although all scientific ideas are tentative and subject to change, and theories may be disagreed upon where research is active, for most major ideas in science, there is much experimental and observational confirmation

Indicator B: Understands the impact of science and technology on human activity and the environment as it relates to the past, present and future (Science and Technology – Past, Present and Future)

1. Compares and contrasts the goals of science and technology
2. Explains how scientific knowledge, thinking processes and skills are used to solve problems in a variety of careers
3. Describes a technological discovery that has influenced science and a scientific discovery that has influenced technology. Determines scientific processes involved in technological advancement
4. Describes and compares the intended benefits and unintended consequences and/or risks of scientific and technologic innovations on society and the quality of life
5. Describes how technology affects the definition of, access to, and use of resources and the effects of population on those resources
6. Describes how human activities can induce hazards through resource acquisition, urban growth, land use decisions, and waste disposal
7. Analyzes the risk factors associated with natural, biological, chemical, social (occupational safety and transportation), and personal (smoking, diet, and drugs) hazards
8. Evaluates the merit of a proposed solution to a human or environmental problem
9. Gives an example that demonstrates that scientists have ethical codes that extend to potential risks to human subjects, property, and communities
10. Gives an example of the interplay between society and the research that gets funded

Indicator C: Understands the characteristics of living things, the diversity of life and how organisms change over time in terms of biological adaptations and genetics. Understands the interrelationships of matter and energy in living organisms and the interactions of living organisms with their environments (Life Science)

1. Identifies the characteristics and structure of living things
2. Constructs classification systems for grouping organisms and identify organisms based on existing classification systems
3. Compares and contrasts the basic structures, components, and functions of different types of cells, tissues, and organs
4. Identifies the systems for digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination in the human body and how those systems work together
5. Describes the theory of evolution; able to describe species' diversity and adaptation, variation, and extinction over geologic time
6. Describes the role of chromosomes and genes in heredity
7. Distinguishes between dominant and recessive traits and describe information that is carried in a gene
8. Identifies the structure and function of systems (e.g., respiratory, digestive, circulatory, nervous), and the function of feedback and equilibrium
9. Explains and models the interaction and interdependence of living and non-living components within ecosystems, including the adaptation of plants and animals to their environment, food webs, resources, and energy

Indicator D: Understands the nature of matter and energy including their forms, the changes they undergo and their interactions (Physical Science)

1. Examines, describes, compares, measures, and classifies objects and mixtures of substances based on common physical and chemical properties (e.g., states of matter,

mass, volume, density, electrical charge, freezing and boiling points, pH, magnetism, solubility)

2. Classifies and describes matter in terms of elements, compounds, mixtures, atoms, and molecules
3. Describes how energy is a property of many substances, occurs in many forms (heat, light, electrical, mechanical, sound, nuclear, and chemical, either potential or kinetic), and can be transferred in many ways
4. Defines the law of conservation of energy
5. Identifies and predicts the properties of matter that will change or will remain unchanged when matter experiences an external force or energy change (e.g., changes of state due to heating and cooling, heat absorption and release when chemicals combine, comparing the force, distance and work involved in simple machines)
6. Describes, measures, and calculates quantities before and after a chemical or physical change within a system and uses that data to support the concept of conservation of mass within a closed system
7. Describes, measures and calculates characteristics (e.g., speed, distance, mass, force, gravity) of moving objects and their interactions (e.g., force, velocity, acceleration, potential energy, kinetic energy) within a system using Newton's laws of motion

Indicator E: Understands the composition, formative processes, and history of the Earth, the solar system and the universe (Earth and Space Science)

1. Describes and models the motion of the Earth in relation to the sun, including the concepts of day, night, season, and year
2. Describes common objects in the universe and explains their relationships including the concepts of multiple star systems, star clusters, galaxies, sun, moon, eclipses, planets, asteroids, comets, and gravity
3. Describes the composition (including the formation of minerals, rocks, and soil) and the structure of the Earth (including landforms, oceans, and lithospheric plates); explains the processes involved in the formation of the Earth's structures
4. Explains how fossils are formed and provides evidence of how life and environmental conditions have changed
5. Explains how Earth processes seen today, including erosion, movement of lithospheric plates, and changes in atmospheric composition, are similar to those that occurred in the past
6. Describes the distribution and circulation of the world's water through ocean currents, glaciers, rivers, ground water, and atmosphere
7. Describes the composition and physical characteristics (including currents, waves, tides, and features of the ocean floor) of the Earth's bodies of water

8. Describes the composition, properties, and structures of the atmosphere, such as the range and distribution of temperature and pressure in the troposphere
9. Observes, analyzes, and records weather patterns and data, including temperature, cloud types, humidity, and dew point over a period of time
10. Explains how technology has impacted both earth and space science by describing some technological advances that have impacted both

ASE I/GED

Indicator A: Understands and uses the processes of scientific investigation and scientific ways of knowing. Able to design, conduct, describe and evaluate these investigations. Able to understand and apply concepts that unify scientific disciplines (Science as Inquiry)

1. Proposes solutions to practical and theoretical problems based on evaluating information gained from scientific investigations
2. Analyzes and evaluates the validity of conclusions based on scientific studies
3. Explains the concept of equilibrium and illustrates the relationship of form to function within natural and designed systems
4. Explains why keeping accurate and detailed records is important

Indicator B: Understands the impact of science and technology on human activity and the environment as it relates to the past, present and future (Science and Technology – Past, Present and Future)

1. Describes how the factors of technology, personalities, world events and societal views can affect the development and acceptance of scientific thought
2. Explains how an accepted idea could be challenged by scientific innovation
3. Illustrates how an invention or discovery could impact further scientific thought
4. Explains how peer review, reporting of methods and outcomes of investigations, and accepting criticism are important to the ethical traditions of science
5. Applies scientific thought processes of skepticism, objectivity and logic to seek a solution to a personal or social/environmental issue
6. Illustrates how increasing human populations affect natural resources and environmental pollution
7. Identifies how technology can affect personal growth using two illustrations
8. Lists three factors that can affect population quality, size, growth, or stability, and identifies the effects of each factor

Indicator C: Understands the characteristics of living things, the diversity of life and how organisms change over time in terms of biological adaptations and genetics. Understands the interrelationships of matter and energy in living organisms and the interactions of living organisms with their environments (Life Science)

1. Explains the processes of photosynthesis and respiration in the interdependency of plants and animals

2. Compares the purpose and process of mitosis with the purpose and process of meiosis
3. Describes how energy is used in maintenance, repair, growth and development of cells
4. Predicts how change in an environmental factor can affect the success or failure of a population to survive
5. Describes how a single-celled organism carries out the function of each of the systems found in multi-celled organisms
6. Describes the physiology of each system in multi-celled organisms and how each relates to homeostasis
7. Identifies the relationship of DNA, genes and chromosomes and explain how a mutation affects this relationship

Indicator D: Understands the nature of matter and energy including their forms, the changes they undergo and their interactions (Physical Science)

1. Explains how the sum of energy and matter in systems remains the same despite transference of energy and change in matter
2. Determines physical and chemical properties of a substance through observation, experimentation and measurement
3. Uses the periodic table to predict the properties of elements and compounds
4. Identifies and measures qualitative and quantitative relationships associated with energy
5. Uses the law of conservation of energy to explain energy changes in chemical reactions
6. Differentiates among elements, atoms and compounds and their relationship to each other
7. Relates equilibrium in Physical Science to homeostasis in Life Science

Indicator E: Understands the composition, formative processes, and history of the Earth, the solar system and the universe (Earth and Space Science)

1. Suggests ways in which the following events affect living organisms: floods, droughts, earthquakes, heat waves, storms, sunspots, novas
2. Explains the principles of hydrology, including surface and ground water flows, aquifers, percolation, desalinization and sources of water contamination and pollution

3. Uses the theory of plate tectonics to explain the relationship among volcanoes, earthquakes, mid-ocean ridges and deep sea trenches
4. Describes how these forces shape the Earth: glaciation, landslides, volcanoes, earthquakes, and wind and water erosion
5. Differentiates among the theories of the origin of: the universe (Big Bang Theory), the solar system (nebular dust and gas), and life forms (evolution and creation)
6. Illustrates the Earth's tilt, rotation and revolution and their effects on the seasons and the length of days

ASE II

Indicator A: Understands and uses the processes of scientific investigation and scientific ways of knowing. Able to design, conduct, describe and evaluate these investigations. Able to understand and apply concepts that unify scientific disciplines (Science as Inquiry)

1. Designs and conducts an investigation of a scientific problem, and reports results to peers, teachers, and others
2. Analyzes a scientific presentation by weighing the evidence and examining the logic in order to reach a decision to the reliability of the results
3. Predicts the effects of various factors on the equilibrium of a system
4. Analyzes an argument by reviewing current scientific understanding, weighing the evidence and examining the logic so as to determining the validity of the argument

Indicator B: Understands the impact of science and technology on human activity and the environment as it relates to the past, present and future (Science and Technology – Past, Present and Future)

1. Chooses a major invention or discovery of the past and illustrates how that development affected society and further scientific developments
2. Traces the development of a selected invention, theory or discovery from its inception to modern day
3. Proposes and tests a solution to an existing social or personal problem
4. Designs a product to meet a personal or societal need; tests the product and evaluates the test results
5. Differentiates among sudden disastrous natural occurrences and slower progressive natural hazards and their effects on human populations
6. Suggests several possible ways to avoid the effects of natural disasters on human populations
7. Identifies the basic processes of natural ecosystems, and explains how these processes affect and are affected by humans

Indicator C: Understands the characteristics of living things, the diversity of life and how organisms change over time in terms of biological adaptations and genetics. Understands the interrelationships of matter and energy in living organisms and the interactions of living organisms with their environments (Life Science)

1. Explains how exposure to certain factors (e.g., sunlight, ozone, drugs, nitrates) may increase the rate of mutation and cause variances in human diversity
2. Describes how mutations contribute to genetic diversity
3. Using scientific evidence, illustrates that descent from common ancestors produced today's diversity of organisms
4. Describes how an environmental change could affect various species within an ecosystem

Indicator D: Understands the nature of matter and energy including their forms, the changes they undergo and their interactions (Physical Science)

1. Demonstrates the use of conceptual models in science (e.g., graphs, diagrams, formulae, etc.)
2. Uses the universal laws of gravitation to predict how gravity force changes with a change of distance and/or mass
3. Uses the 1st Law of Thermodynamics to explain the energy changes in a physical system
4. Describes a sequence of events that illustrates the 2nd Law of Thermodynamics
5. Differentiates between gravitational and electromagnetic forces

Indicator E: Understands the composition, formative processes, and history of the Earth, the solar system and the universe (Earth and Space Science)

1. Discusses the costs, benefits and consequences of natural resource exploration, development and consumption
2. Analyzes energy in the Earth's system, including radioactive decay, geo-chemical cycles, gravitational energy, internal and external sources of energy, weather and climate
3. Describes the factors that influence the reuse, recycling and conservation of water
4. Analyzes how weather is influenced by natural and artificial features and by natural and artificial dynamic processes